

Application Serial No. 10/750,693
Amendment After Final dated April 28, 2006
Reply to Final Office Action dated March 7, 2006

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (previously presented): A refrigeration system module for heating or cooling an object, said module comprising:

an enclosure having a refrigeration system disposed therein, said refrigeration system including a vapor compression circuit for circulating a refrigerant and having a compressor, a first heat exchanger, an expansion device and a second heat exchanger operably disposed therein in serial order;

said first heat exchanger defining a first outward facing surface of said enclosure, said first surface being a thermal exchange surface wherein said first heat exchanger provides thermal communication between said first surface and refrigerant flowing within said first heat exchanger; said second heat exchanger defining a second outward facing surface of said enclosure; said second surface being a thermal exchange surface wherein said second heat exchanger provides thermal communication between said second surface and refrigerant flowing within said second heat exchanger, said first and second surfaces being disposed on opposite sides of said enclosure; and

at least one attachment feature disposed on said module wherein said at least one attachment feature is attached to the object to thereby secure the object in thermal communication with at least one of said first and second surfaces.

Claim 2 (original): The refrigeration system module of claim 1 wherein said at least one attachment feature comprises at least one aperture disposed proximate each of the first and second surfaces wherein a fastener is insertable through each of the apertures.

Claim 3 (original): The refrigeration system module of claim 1 wherein said first and second surfaces have substantially similar surface areas.

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Claim 4 (previously presented): In combination:

a first refrigeration system module for heating or cooling an object, said first module comprising:

an enclosure having a refrigeration system disposed therein, said refrigeration system including a vapor compression circuit for circulating a refrigerant and having a compressor, a first heat exchanger, an expansion device and a second heat exchanger operably disposed therein in serial order;

said first heat exchanger defining a first outward facing surface of said enclosure, said first surface being a thermal exchange surface wherein said first heat exchanger provides thermal communication between said first surface and refrigerant flowing within said first heat exchanger; said second heat exchanger defining a second outward facing surface of said enclosure; said second surface being a thermal exchange surface wherein said second heat exchanger provides thermal communication between said second surface and refrigerant flowing within said second heat exchanger, said first and second surfaces being disposed on opposite sides of said enclosure and having substantially similar surface areas;

at least one attachment feature disposed on said module wherein said at least one attachment feature is attached to the object to thereby secure the object in thermal communication with at least one of said first and second surfaces; and

a second module wherein said at least one attachment features of said first and second modules are secured together and said first surface of one of said first and second modules is in thermal communication with said second surface of the other of said first and second modules.

Claim 5 (previously presented): In combination:

a first refrigeration system module for heating or cooling an object, said first module comprising:

an enclosure having a refrigeration system disposed therein, said refrigeration system including a vapor compression circuit for circulating a refrigerant and having a compressor, a first heat exchanger, an expansion device and a second heat exchanger operably disposed therein in serial order;

said first heat exchanger defining a first outward facing surface of said enclosure, said first surface being a thermal exchange surface wherein said first heat exchanger

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provides thermal communication between said first surface and refrigerant flowing within said first heat exchanger; said second heat exchanger defining a second outward facing surface of said enclosure; said second surface being a thermal exchange surface wherein said second heat exchanger provides thermal communication between said second surface and refrigerant flowing within said second heat exchanger, said first and second surfaces being disposed on opposite sides of said enclosure and having substantially similar surface areas;

at least one attachment feature disposed on said module wherein said at least one attachment feature is attached to the object to thereby secure the object in thermal communication with at least one of said first and second surfaces; and

a second module wherein said at least one attachment features of said first and second modules are secured together and said attachment features comprise a plurality of apertures disposed adjacent each of said first and second surfaces of each of said first and second modules and said first surface of one of said first and second modules is in thermal communication with said second surface of the other of said first and second modules.

Claim 6 (original): The refrigeration system module of claim 1 wherein said compressor is a hermetically sealed compressor mounted within said enclosure and said enclosure provides communication between an interior of the enclosure and the ambient environment.

Claim 7 (original): A modular refrigeration system comprising:

a plurality of refrigeration system modules, each of said modules comprising:
an enclosure having a refrigeration system disposed therein, said refrigeration system including a vapor compression circuit for circulating a refrigerant and having a compressor, a first heat exchanger, an expansion device and a second heat exchanger operably disposed therein in serial order;

said first heat exchanger defining a first outward facing surface of said enclosure, said first surface being a thermal exchange surface wherein said first heat exchanger provides thermal communication between said first surface and refrigerant flowing within said first heat exchanger; said second heat exchanger defining a second outward facing surface of said enclosure; said second surface being a thermal exchange surface wherein said second heat exchanger provides thermal communication between said second surface and refrigerant flowing

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within said second heat exchanger, said first and second surfaces being disposed on opposite sides of said enclosure; and

at least one attachment feature disposed on said module wherein said at least one attachment feature is attachable to another one of said modules to thereby secure the first surface of one of said plurality of modules in thermal communication with the second surface of another one of said plurality of modules.

Claim 8 (original): The modular refrigeration system of claim 7 wherein for each of said modules said at least one attachment feature comprises a plurality of apertures disposed adjacent each of said first and second surfaces.

Claim 9 (original): The modular refrigeration system of claim 7 wherein for each of said modules said compressor is a hermetically sealed compressor mounted within said enclosure and said enclosure provides communication between an interior of the enclosure and the ambient environment.

Claim 10 (cancelled)

Claim 11 (previously presented): In combination:

a first refrigeration system module, comprising:

a frame;

a heating plate having a fluid inlet and a fluid outlet and a first heat transfer surface;

a cooling plate having a fluid inlet and a fluid outlet and a second heat transfer surface;

an expansion device disposed between said heating and cooling plates and in fluid communication with said heating plate fluid outlet and said cooling plate fluid inlet; and

a hermetic compressor assembly comprising a housing, an electric motor and a compression mechanism, said compression mechanism being driven by said motor, said compressor assembly disposed between said heating and cooling plates and having a discharge outlet in fluid communication with said heating plate fluid inlet, and a suction inlet in fluid communication with said cooling plate fluid outlet;

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wherein said heating plate, said cooling plate, said expansion device and said compressor assembly are fixed to said frame, and said first and second heat transfer surfaces each at least partially define an exterior surface of said module; and

a second said module connected to said first module, said first heat transfer surface of one of said first and second modules being in conductive communication with said second heat transfer surface of the other of said first and second modules.

Claim 12 (previously presented): In combination:

a first refrigeration system module, comprising:

a frame;

a heating plate having a fluid inlet and a fluid outlet and a first heat transfer surface;

a cooling plate having a fluid inlet and a fluid outlet and a second heat transfer surface;

an expansion device disposed between said heating and cooling plates and in fluid communication with said heating plate fluid outlet and said cooling plate fluid inlet; and

a hermetic compressor assembly comprising a housing, an electric motor and a compression mechanism, said compression mechanism being driven by said motor, said compressor assembly disposed between said heating and cooling plates and having a discharge outlet in fluid communication with said heating plate fluid inlet, and a suction inlet in fluid communication with said cooling plate fluid outlet;

wherein said heating plate, said cooling plate, said expansion device and said compressor assembly are fixed to said frame, and said first and second heat transfer surfaces each at least partially define an exterior surface of said module; and

a second said module connected to said first module, said first heat transfer surface of one of said first and second modules being in conductive communication with said second heat transfer surface of the other of said first and second modules, wherein said first heat transfer surface of one of said first and second modules and said second heat transfer surface of the other of said first and second modules are non-planar mating surfaces.

Claims 13-16 (cancelled)

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Claim 17 (original): A modular refrigeration system, comprising a plurality of refrigeration system modules, each said module including:

a heating plate having a fluid inlet and a fluid outlet and a first heat transfer surface;

a cooling plate having a fluid inlet and a fluid outlet and a second heat transfer surface, said first and second heat transfer surfaces each at least partially defining an exterior surface of said module;

an expansion device disposed between said heating and cooling plates and in fluid communication with said heating plate fluid outlet and said cooling plate fluid inlet; and

a compressor assembly disposed between said heating and cooling plates and having a discharge outlet in fluid communication with said heating plate fluid inlet, and a suction inlet in fluid communication with said cooling plate fluid outlet;

wherein said plurality of refrigeration system modules are configured to be connected to each other in series.

Claim 18 (original): The system of claim 17, wherein said first heat transfer surfaces are configured to be in conductive communication with said second heat transfer surfaces of other said modules when said modules are connected to each other in series.

Claim 19 (original): The system of claim 18, wherein said first heat transfer surfaces and said second heat transfer surfaces are non-planar surfaces wherein peaks of one surface are received in valleys of the other surface.

Claim 20 (original): The system of claim 17, wherein said plurality of refrigeration system modules are configured to be bolted together.

Claim 21 (original): The system of claim 17, wherein each said module further includes a frame, and wherein said heating plate, said cooling plate, said expansion device and said compressor assembly are fixed to said frame.

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Claim 22 (original): The system of claim 17, wherein each said compressor assembly includes a housing, an electric motor, and a compression mechanism, said compression mechanism being driven by said motor.

Claim 23 (original): The system of claim 17, wherein each said compressor assembly is hermetic.

Claim 24 (previously presented): A refrigeration system, comprising:

first and second modules, each of said first and second modules having a heating plate, a cooling plate, an expansion device, and a compressor assembly;

each said heating plate having a fluid inlet and a fluid outlet and a first heat transfer surface;

each said cooling plate having a fluid inlet and a fluid outlet and a second heat transfer surface;

each said expansion device disposed between respective said heating and cooling plates and in fluid communication with the respective heating plate fluid outlet and the respective cooling plate fluid inlet; and

each said compressor assembly disposed between respective said heating and cooling plates and having a discharge outlet in fluid communication with the respective heating plate fluid inlet, and a suction inlet in fluid communication with the respective cooling plate fluid outlet;

wherein said first and second heat transfer surfaces each at least partially define an exterior surface of the respective said module; and

said first heat transfer surface of one of said first and second modules being in conductive communication with said second heat transfer surface of the other of said first and second modules.

Claim 25 (cancelled)

Claim 26 (previously presented): The combination of claim 24, wherein said first heat transfer surface of one of said first and second modules and said second heat transfer surface of the other of said first and second modules are sawtoothed.

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Claim 27 (previously presented): The combination of claim 24, wherein said first heat transfer surface of one of said first and second modules and said second heat transfer surface of the other of said first and second modules are of matching areas.

Claim 28 (previously presented): The system of claim 24, wherein each said module further includes a frame, and wherein the respective heating plate, the respective cooling plate, the respective expansion device and the respective compressor assembly are fixed to said frame.

Claim 29 (original): The system of claim 24, wherein said compressor assembly includes a housing, an electric motor, and a compression mechanism, said compression mechanism being driven by said motor.

Claim 30 (original): The system of claim 24, wherein said compressor assembly is hermetic.

Claims 31 - 34 (cancelled)